ONTARIO DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

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# TALC IN ONTARIO

By

D. F. Hewitt

INDUSTRIAL MINERAL REPORT 40

1972

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By

D. F. Hewitt

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# TALC IN ONTARIO

By

D.F. Hewitt[1]

## INTRODUCTION

The mineral talc is a hydrous magnesium silicate having the theoretical formula, $H_2Mg_3(SiO_3)_4$, with the composition as follows: silica, 63.5 percent; magnesia, 31.7 percent; water, 4.8 percent. It has a hardness of 1 to 1.5, a specific gravity of 2.7 to 2.8, perfect basal cleavage, and pearly to greasy lustre. The colour is white, green, or yellow. It is translucent and has a greasy feel.

It grinds to a white powder and is widely used as a filler in paint, paper, rubber goods, roofing, textiles, insecticides, linoleum, tile, and cleaning compounds. It is a common constituent in some ceramic bodies. It is used in pharmaceutical and toilet preparations where a high purity talc is required. Some talc is used in foundry facings.

It commonly occurs as a hydrothermal secondary alteration of marble or serpentinized ultramafic rocks. It is associated with calcite, dolomite, tremolite, and asbestos in many places.

Talc has been mined continuously in the Madoc area of Ontario since 1896 when the Henderson Mine opened. Total talc production from the Madoc deposits, up to the end of 1970, amounted to 809,115 tons valued at $9,576,882.

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[1]Chief, Industrial Minerals Section, Ontario Department of Mines and Northern Affairs. Manuscript accepted for publication 17 December 1971.

## Varieties

Steatite is a fine-grained massive variety of talc. When talc is formed by processes of hydrothermal alteration in a rock, the process is referred to as 'steatitization'. In the ceramic trade the term 'steatite' is applied to high purity talc suitable for ceramic bodies, particularly electrical insulators.

Talc is commonly formed by the alteration of serpentinized dolomite or ultramafic rocks. The resulting impure soft talcose rock, which usually contains serpentine, is called 'soapstone'. Soapstone can be readily sawn or carved. From earliest times soapstone was used by primitive peoples for domestic utensils and ornamental objects such as sculptures, beads, and necklaces.

Soapstone now has only a limited use as sawn refractory bricks or blocks. The principal uses are for crayons and carvings.

## Mineralogy and Composition

Talc is monoclinic, negative, with the following indices of refraction: $\alpha$, 1.539 to 1.550; $\beta$, 1.589 to 1.594; $\gamma$, 1.589 to 1.600. The theoretical chemical composition is $H_2O.3MgO.4SiO_2$ with: $SiO_2$, 63.5 percent; MgO, 31.7 percent; and $H_2O$, 4.8 percent.

Talc has a layered structure having a sheet of octahedrally coordinated Mg ions between two sheets of linked $SiO_4$ tetrahedra. Figure 1 is a diagram of the structure of talc as viewed along x axis (after Pask and Warner 1954, p.119). They describe the atomic structure of talc as consisting of a brucite sheet sandwiched between two silica sheets, forming talc layers that are superimposed indefinitely. Pask and Warner (1954)

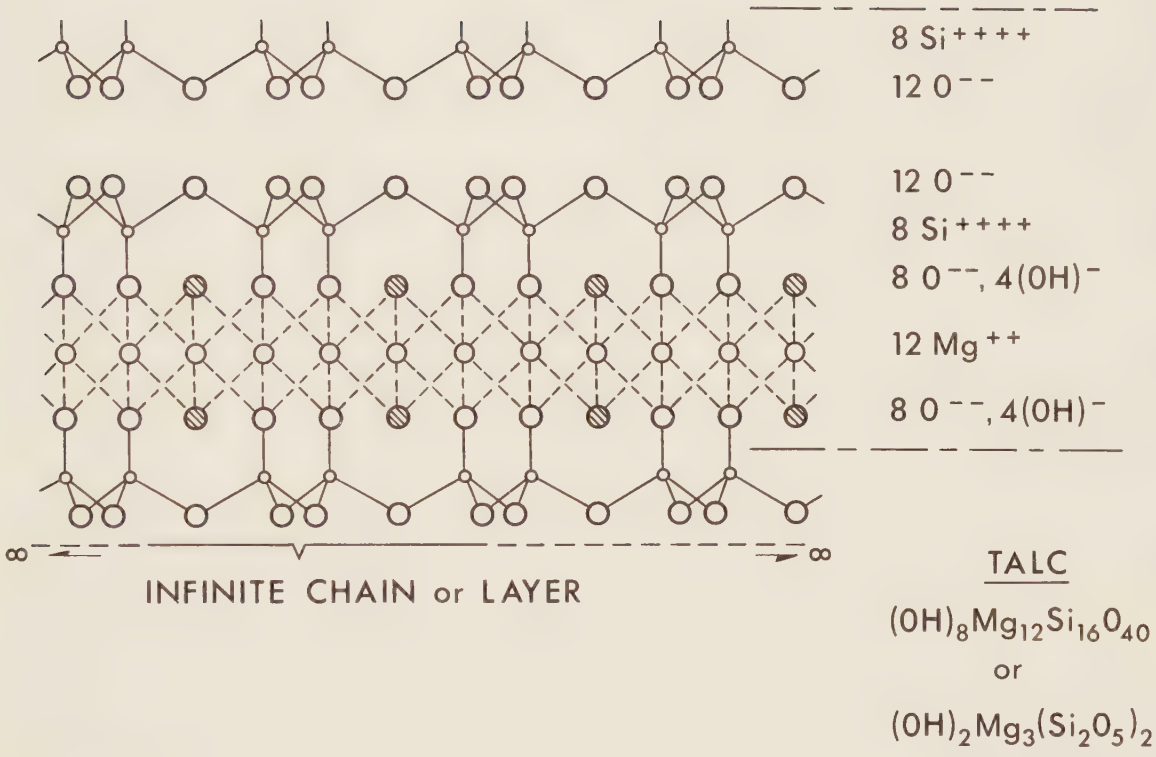


Figure 1- Diagram of the structure of talc as viewed along x axis (after Pask and Warner 1954, p.119).

indicate that there are irregular shifts in the stackings of the talc layers and that the layers are held together very weakly, which accounts for the excellent basal cleavage and slipperiness of the talc.

Although solid solution substitutions of iron and aluminium for magnesium, and aluminium for silicon are possible in the talc structure, these substitutions do not appear to be common. Commercial talcs very rarely approach the theoretical composition of $H_2O.3MgO.4SiO_2$. This is due to lattice intergrowths of talc with one or more of the following materials:

Anthophyllite ($H_2O.7MgO.8SiO_2$)

Tremolite ($H_2O.2CaO.5MgO.8SiO_2$)

Actinolite ($H_2O.2CaO.5(Mg,Fe)O.8SiO_2$)

Penninite ($11MgO.Al_2O_3.7SiO_2.8H_2O$)

Clinochlore ($10MgO.2Al_2O_3.6SiO_2.8H_2O$)

Prochlorite ($9MgO.3Al_2O_3.5SiO_2.8H_2O$)

Amesite ($8MgO.4Al_2O_3.4SiO_2.8H_2O$)

Serpentine ($6MgO.4SiO_2.4H_2O$)

or intimate admixtures with calcite, dolomite, ankerite, magnesite, diopside, or quartz.

Commercial talcs are almost invariably mixtures of the above minerals and Table 1 gives some typical chemical analyses of commercial talcs. Mineral impurities such as tremolite may impart desirable physical properties to the talc filler and certain talcs from New York may carry 50 percent or more tremolite and less than 25 percent talc (Engel and Wright 1960, p.836).

Table 1 | Chemical Analyses of Some Commercial Talcs

| Sample | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Constituent | | | | | | |
| $SiO_2$ | 45.04 | 48.72 | 29.38 | 17.10 | 59.80 | 59.61 |
| MgO | 30.16 | 29.95 | 26.07 | 22.94 | 27.45 | 30.01 |
| CaO | 8.75 | 8.01 | 18.12 | 25.57 | 6.80 | 0.84 |
| $Fe_2O_3$+$Al_2O_3$ | 0.96 | 1.34 | 1.26 | 1.14 | 0.77 | 2.57 |
| Ignition loss | 15.17 | 11.93 | 25.35 | 33.31 | 4.75 | 5.94 |

1. Cantal F B Talc, Canada Talc Industries Limited.
2. Cantal D Talc, Canada Talc Industries Limited.
3. Canfil 325 Talc, Canada Talc Industries Limited.
4. Talfil 325 Talc, Canada Talc Industries Limited.
5. Talc from Gouverneur area, New York; Engel and Wright (1960, p.835).
6. Steatite-grade talc, Inyo County, California; Engel and Wright (1960, p.835).

## Properties and Uses

Talc is widely used as a filler or as a constituent in ceramic bodies. Among the desirable properties it exhibits that are valued for certain uses are: extreme whiteness (ranging up to 98 when compared with an MgO standard); smoothness, softness, and slip, which are valued in some filler and cosmetic uses; a flaky or fibrous particle shape, depending on percentage

of talc or tremolite present, with a large surface area compared to its density; good covering power in paints; chemical inertness; low electrical and thermal conductivity making it suitable for insulators; a high fusion point and dielectric strength.

In Canada in 1966 and 1967, figures for consumption of ground talc, as given by the Dominion Bureau of Statistics, are as follows:

| Uses | Tonnage | |
|---|---|---|
| | 1966 | 1967 |
| Ceramic products | 8412 | 6754 |
| Paints and wall joint sealers | 6587 | 6500 |
| Roofing | 6315 | 6557 |
| Paper and paper products | 2164 | 2968 |
| Rubber | 1617 | 1264 |
| Insecticides | 860 | 620 |
| Toilet preparations | 719 | 761 |
| Cleaning compounds | 685 | 644 |
| Pharmaceutical preparations | 451 | 423 |
| Linoleum and tile | 1967 | 363 |
| Other products | 5264 | 5689 |
| | 35,041 | 32,543 |

## Ceramic Products

Talc is used in ceramic products as a source of magnesia, which acts as a flux and promotes vitrification of the ceramic bodies. It improves thermal shock characteristics and allows more rapid firing of the ware. It has the advantage in electrical porcelain of high electrical resistance, low

dielectric loss, and low power factor.

Talc is used mainly in whiteware, floor and wall tile, semi-vitreous tableware, electrical porcelain, and kiln furniture. Talc decreases crazing in wall tile and dinnerware.

## Paint Industry

White talc of high quality is used as an extender in paints. A low content of carbonates and grit is usually desirable. Specifications are strict with regard to oil absorption, particle size and shape. Tremolitic talc is desirable due to the particle shape of the tremolite blades. Specifications commonly cite particle size, apparent density, oil absorption, acid solubles, pH, specific gravity, and colour. Mesh size is usually over 99 percent through 325 mesh or finer.

## Roofing

Lower grade talcs of poor colour may be used by the roofing industry as a filler and an inert, fireproof, weather-resistant coating for tar paper, roll-roofing, and asphalt shingles. For this use price is usually an important consideration.

## Paper and Paper Products

Talc is a common mineral filler for paper. Colour or brightness, particle size and shape, smoothness, percent grit, gloss, weight, and printability are factors in evaluating mineral fillers for paper. The good retention, white colour, high reflectance, and inertness of talc makes it

particularly suitable for a paper filler. Micronized talc provides a high gloss finish for coated papers.

## Rubber Industry

The rubber industry ranks fifth in order of talc consumption in Canada. Talc is mainly used for dusting, lubricating molds, and coating rubber surfaces to prevent sticking. Specifications as to colour and talc content are not stringent and lower grade talcs are used in the rubber industry.

## Other Uses

Talc is used as a carrier for insecticides and a constituent of some cleaning compounds. For toilet and pharmaceutical preparations high grade talcs that are of good colour and free from grit are employed. Talc is also used as a dusting agent and filler for linoleum, and for asphalt pipeline enamels, walljoint compounds, and auto-body patching compounds.

J.H. Morgan (Reeves and Morgan 1961, p.675) stated that: 'Most of the talc consumed in Canada in roofing, asphalt compounds, insecticides and so on - that is, the lower grades - is produced in Canada. Most of the high-grade talc used in paint, paper, cosmetics and ceramics is imported. Cosmetic-grade talc is brought in from Italy and the USA. Tremolitic talc, used in paints and ceramics, is imported, mostly from the Gouverneur region of northern New York State. Beneficiated talc is produced by froth flotation from deposits at Johnston, Vermont. This relatively pure talc is used in Canada as a mineral filler in compounding rubber, and in paints and paper. A small tonnage of talc is imported from California. This is high-value, very finely pulverized talc, that is minus six microns in average

particle size. It is used for pitch control in pulp mills and for special filler applications. Talc used as a paper filler and coater is imported because Canadian talc produced at present is too gritty for this purpose.'

## DESCRIPTION OF ACTIVE PROPERTIES

The only active talc mines in Ontario are the Henderson and Conley Mines operated at Madoc by Canada Talc Industries Limited.

### Canada Talc Industries Limited

Canada Talc Industries Limited operates the Henderson and Conley talc mines at Madoc. Talc was discovered at Madoc in the 1880s, and in 1896 the first talc mine, the Henderson Mine, was opened. It was operated by the A.H. Robbins Company of New York until 1904, and then by Cross and Wellington of Madoc, under contract with the Robbins Company, until 1918. In 1918 the property was purchased by the George H. Gillespie Company of Madoc. Henderson Mines Limited, a subsidiary of the George H. Gillespie Company, operated the mine until 1937, when it was taken over by Canada Talc Limited.

The Conley Mine is on the northeastward extension of the Henderson orebody. It was discovered in 1911 by Henderson and Pitt, and development work was done on the property by the Hungerford Syndicate in 1912 and 1913. In 1915 the Anglo-American Talc Corporation took over the property and worked it until 1921, when the Asbestos Pulp Company took over the operation. The company was reorganized as Canada Talc Company in 1929, and, on merger of the Henderson and Conley properties in 1937, the company was again

Photo 1–Conley No. 3 shaft and mill, Canada Talc Industries.

Photo 2–Henderson No. 4 shaft, from open pit.

reorganized as Canada Talc Limited. The company operated the Conley Mine until 1951, when Canada Talc Limited was purchased by Canada Talc Industries Limited. Since 1937 Canada Talc Limited and Canada Talc Industries Limited have operated both the Henderson and Conley Mines.

Current production by Canada Talc Industries amounts to about 20,000 tons per year. A substantial tonnage of white terrazzo chips is also produced. Total talc production from the Madoc deposits up to the end of 1970 amounted to 809,115 tons valued at $9,576,882.

## Henderson Mine

The talc deposit was first opened up on the Henderson property, lot 14, concession XIV, Huntingdon Township, by open pit methods, and open pit mining continued until 1908. In 1908 a No. 1 shaft was sunk at the western end of the orebody. By 1911, the No. 1 shaft was down to 185 feet with levels at 75, 120, and 185 feet. Mining was by square-set timbering on the upper levels, and by shrinkage stoping on the lower level. In 1912, a second shaft was put down, east of No. 1 shaft, towards the eastern end of the orebody, and in 1913, the No. 1 shaft was abandoned owing to caving. A fourth level was established at 231 feet and mining continued. However, both No. 1 and No. 2 shafts were in the orebody, and as mining continued No. 2 shaft was also in danger of caving in the bad ground of the talc orebody. In 1920, the No. 3 shaft was put down in the country rock between shafts No. 1 and No. 2, well to the north of the orebody, and this shaft, now known as No. 4 shaft of the combined Conley-Henderson property, is still in use as an escape-way. No. 1 and No. 2 shafts were lost when the ground caved, and the workings are now caved from the surface open pit to the fifth level

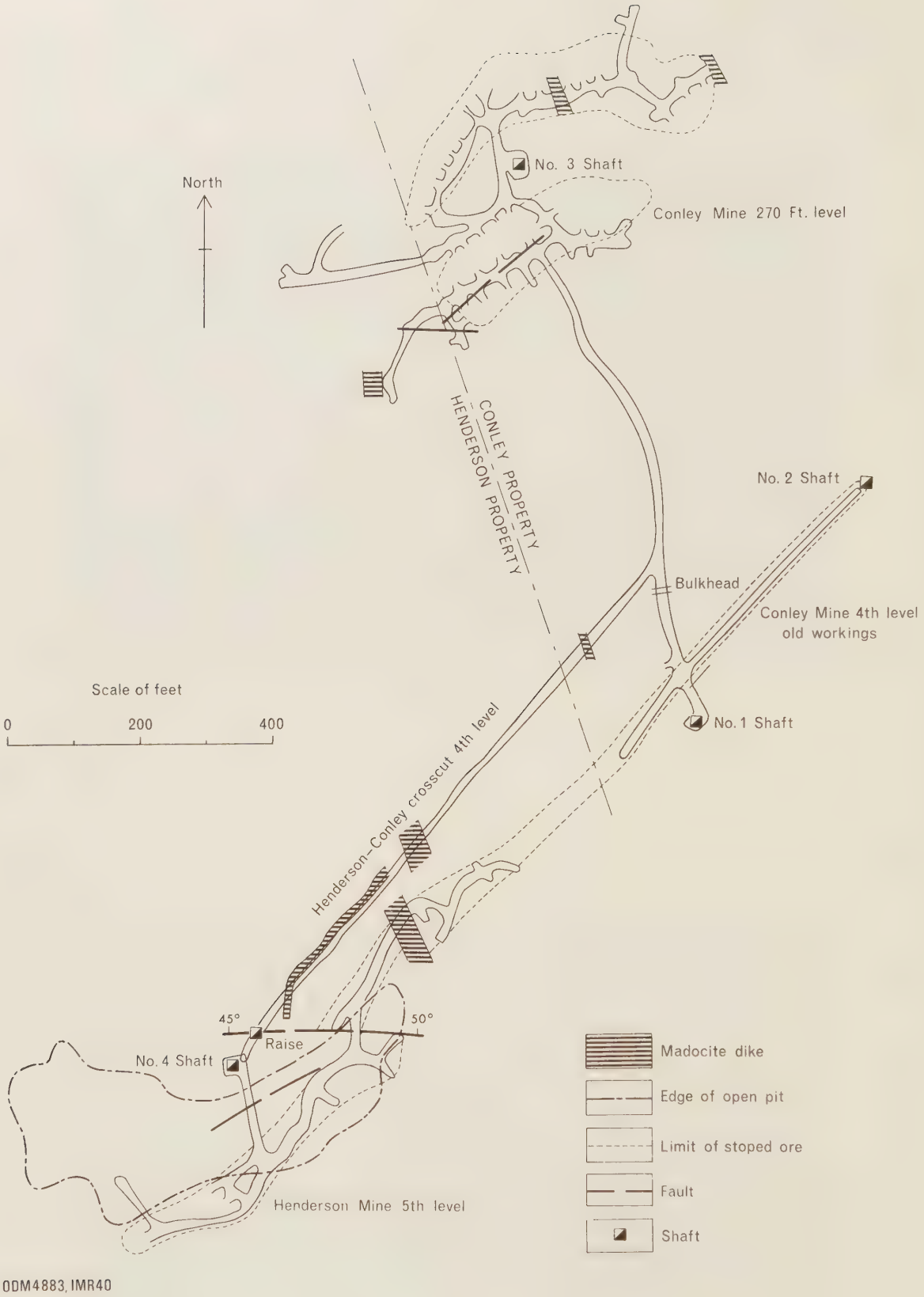


Figure 2—Composite plan of Henderson and Conley Mines, Canada Talc Industries Limited.

(303 feet). By 1928 work was carried down to the sixth level (371 feet), and by 1933 drives had been carried out to the end of the ore both east and west of the shaft. In 1938 the shaft was deepened to 541 feet, and a level was cut at 443 feet. This level, the seventh, was developed in 1943, and work was carried out on this level for many years by Canada Talc Industries. A new and deeper level has been developed at the Henderson Mine from a crosscut from the third level (542 feet) at the Conley Mine. This level is now fully developed. All talc ore is now coming from the Henderson property via the Conley Shaft. The width of the talc orebody on the Henderson bottom level ranges from 15 to 55 feet over a length of 700 to 800 feet. This is mined by drifting parallel to the orebody on both sides of the ore zone and tapping the orebody with draw points at approximately 30-foot centres.

## Conley Mine

The Conley Mine, situated on the western half of lot 15, concession XIV, Huntingdon Township, was originally developed on the northeastern extension of the Henderson orebody. It did not outcrop, but was discovered by test pitting. In 1916, the No. 1 shaft was sunk about 100 feet east of the Henderson line on the wallrock south of the ore zone. Levels were established at 65 and 130 feet. In 1919, the No. 2 shaft was started 300 feet northeast of the main shaft. This shaft was carried to a depth of 168 feet where it was found that the ore had pinched out with depth in this northeast shaft. Subsequent work was carried out entirely from No. 1 shaft. By 1929 the orebody was traced to the sixth level at a depth of 390 feet. The vein was reported to average 15 feet wide, with a maximum width of 66 feet. The ore

length on the first level was about 400 feet eastwards from the Henderson line, but on the eighth level the ore extended only 150 feet east of the Henderson line. The seventh level was opened in 1933 at a depth of 437 feet. Subsequently, in 1934, the eighth level was opened at 470 feet by means of a winze in the ore from the seventh level at a point 20 feet east of the shaft. In 1934, a crosscut driven north on the fourth level intersected a new orebody, which was discovered by diamond drilling, 650 feet north of the old No. 1 shaft. Some stoping was carried out.

In 1935, the No. 3 shaft was sunk near the new orebody. The first level for the No. 3 shaft was established at 270 feet. This level was connected to the workings at the No. 1 shaft by a long crosscut that joined these workings at the fourth level.

In 1938, after the merger of the Conley and Henderson Mines, the workings of these mines were joined by a crosscut from the 4th level of No. 1 shaft in the Conley Mine. This reached the Henderson workings between the fourth and fifth levels, and is reached by a raise from the fifth level. In 1942, the Conley No. 3 shaft was deepened to 383 feet, and a second level was established at 370 feet. In 1964, the Conley No. 3 shaft was deepened to 611 feet. The third level was established at 542 feet, and a loading pocket was established at 584 feet. From the Conley third level at No. 3 shaft, a crosscut was run to intersect the Henderson orebody below the Henderson seventh level, and development on this new level was begun on the Henderson side. The old Conley workings on No. 1 and No. 2 shafts are now sealed off.

Dolomite for terrazzo chips and ore for TALFIL comes from a new stope developed about 400 feet west of the Conley (No. 3) shaft on the Henderson property, as shown on Figure 3.

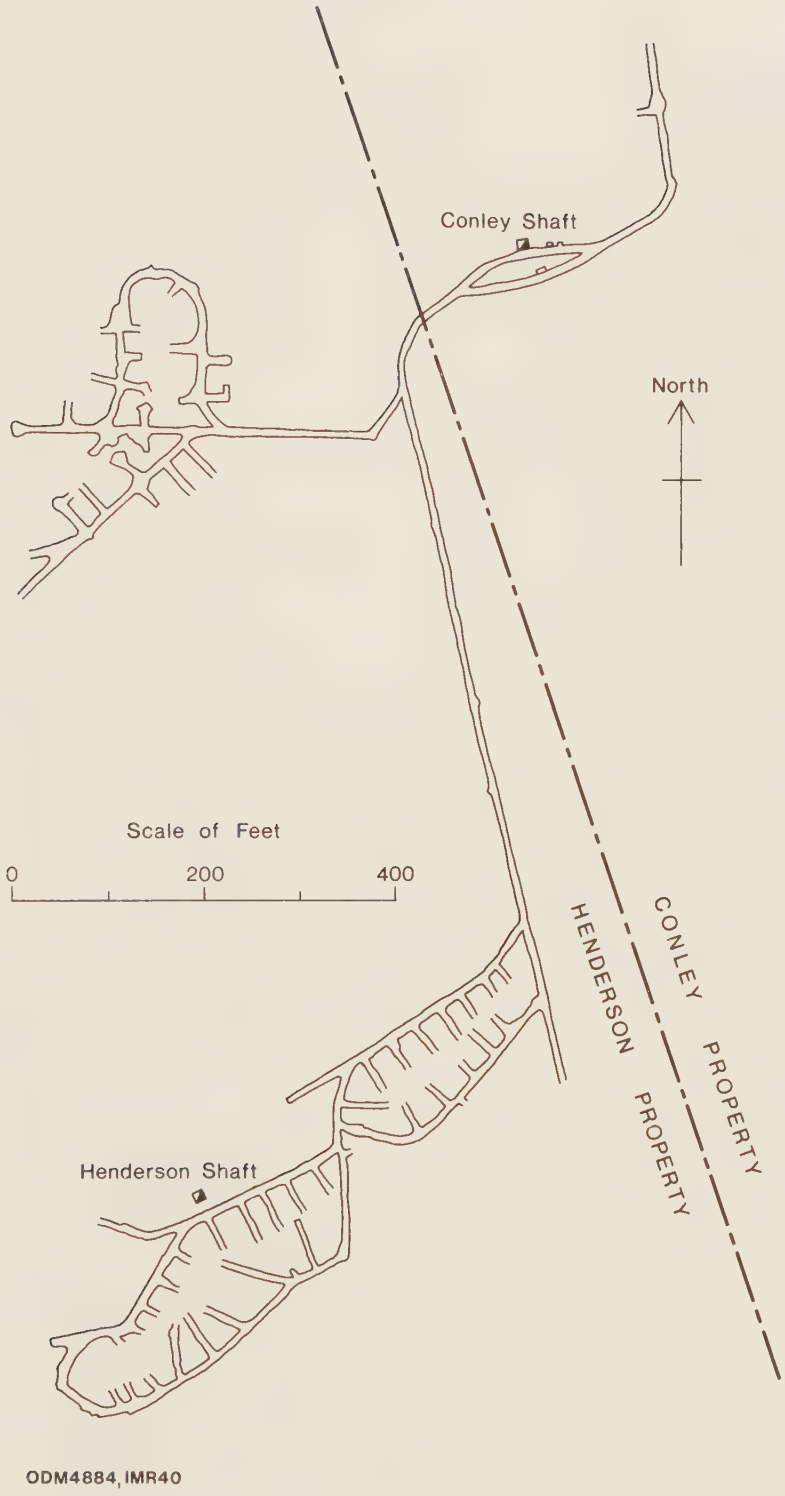


Figure 3– Lower (third) level at Henderson and Conley Mines.

## General Geology

The talc orebodies occur in Grenville crystalline dolomite of Precambrian age. The Grenville formations in the vicinity of the mine consist of tremolitic crystalline dolomite and dolomitic limestone, interbanded quartzite and crystalline dolomite, quartzite, and talc mica schist. The regional structure appears to be anticlinal (Sandomirsky 1954) with the anticline pitching steeply to the southwest. The west limb strikes N10W to N20W and dips vertically. The south limb strikes N70E and dips vertically to overturned 70° to the north. Strong dragfolding and crenulation can be observed on both limbs of the fold. The crest of the fold appears to be just west of the open pit on the Henderson property.

The talc occurs as tabular hydrothermal replacement bodies in crystalline dolomite. The Grenville metasediments are cut by mafic dikes, which were named 'madocite' by M.E. Wilson (1926, p.80). These dark coloured dikes consist predominantly of black tourmaline, amber mica, tremolite, and plagioclase, and minor amounts of pyrite, arsenopyrite, quartz, actinolite, titanite, apatite, and zircon. In places the madocite dikes appear to have chilled margins against the dolomite. These dikes are evidently pre-faulting because some of them are displaced by faulting, and they are folded in the general folding of the Grenville metasediments. The Grenville metasediments are also intruded by the Moira Granite, a pink albitic granite, that outcrops southeast of No. 1 shaft on the Conley property. Wilson (1926) believed that the Moira Granite was the source of the madocite dikes and the probable source of the hydrothermal solutions that formed the talc replacement bodies.

The orebodies lie within the crystalline dolomite formation that consists of well-banded grey and white crystalline dolomite and tremolitic

Figure 4—General geology of Canada Talc Industries property.

dolomite. Tremolite occurs in needles and blades distributed through the rock and in clots, knots, and bands in irregular segregations in the dolomite. The banding is from 2 to 6 inches wide, and is moderately persistent. Some of the tremolitic dolomite also contains talc and white mica. North of the ore zone in the Henderson Mine there is a band of mottled brecciated dolomite consisting of fine-grained dark grey dolomite in a matrix of white tremolitic dolomite. This appears to be incipient hydrothermal alteration of brecciated dolomite to tremolite, and probably was the initial step in the dolomite-tremolite-talc hydrothermal alteration. Other lithologic types noted in the mine workings include dense fine-grained apple-green steatite, plums of good quality, pure-white foliated talc, and zones of rather hard mica-talc schist. Pyrite crystals are found scattered through the various rock types.

Bands of grey-white fine-grained quartzite are in the mine workings. On the surface south of the main pit, outcrops of well-bedded quartzite in 1-inch to 3-inch beds are exposed. The beds of quartzite are strongly crumpled and folded, and in places they are brecciated. Interlaminated tremolitic crystalline dolomite and quartzite occurred in narrow alternating bands, which weather on outcrop to give a distinctive ribbed appearance. Some quartz stringers or mobilized quartzite cut the dolomite.

Remnants of Paleozoic conglomerate rest with unconformity on the Precambrian metasediments.

## Structure

The general structure of the area is not well-known owing to lack of outcrop, but, as previously mentioned, the major structure appears to be anticlinal with the Henderson and old Conley orebodies occurring on the

south limb of an anticline pitching to the southwest. There is strong dragfolding and crenulation on both arms of the fold. The detailed structure within the mine workings is not well known because the workings were not mapped during development, and most of them are now inaccessible.

There is a considerable amount of faulting, although the fault pattern has not been worked out. Wilson (1926) noted that, on the fourth level of the Henderson Mine, the talc orebody is cut by an overthrust fault about 50 feet west of the No. 2 shaft. This fault strikes roughly east-west and dips about 45 to 50 north. On the fourth level, there is an apparent horizontal displacement of about 50 feet. This displacement is reported to fade out into an open fold towards the surface. This fault zone also appears on the fifth and sixth levels of the Henderson Mine. What may be a subsidiary fault, striking somewhat south of west and dipping vertically, can be seen just north of the ore zone on the seventh level of the Henderson Mine. Zones of faulting are also seen in the Henderson-Conley crosscut and in the Conley workings at No. 3 shaft, but no data on these faults are available.

## Orebodies

The Henderson orebody consisted of a tabular sheet of pure white foliated talc, with some impurities of calcite, dolomite, pyrite, and tremolite. This talc body lies on the south limb of the major anticline near its crest. The western end of the orebody appears to occupy the crest of the fold, and at the western end of the orebody the ore pitches to the southwest. The ore sheet appeared to have its maximum extent on the fifth level where the workings extended east-west for over 700 feet.

Wilson (1926) described the orebody as resembling an interrogation mark lying with its top to the west and open to the north. The orebody pitches to the southwest at its western end, but dips north toward its eastern end. Hence the south limb of the anticline is slightly overturned toward the north. The orebody extends downward to the new Conley third level, a depth of 540 feet. The width ranges from a few feet to 65 feet. On the seventh level the ore zone consists of a folded band of steatite and talc schist containing some plums of white foliated talc. The large body of pure foliated talc mined on the upper levels has apparently changed in character on the lower levels, and it is represented by more tremolitic dolomitic material. Towards the eastern end of the orebody, strong folding, faulting, and intrusion of madocite dikes complicate the picture.

The south or original orebody on the Conley property was the eastward extension of the Henderson orebody, and it consists of foliated white talc with some impurities of calcite, tremolite, and dolomite. Laterally it has a maximum length on the third (190-foot) level of about 400 feet east from the Henderson line. The ore pitched to the west and only 150 feet of ore extended eastwards from the Henderson line on the bottom (eighth) level at 470 feet. The width of the ore zone averages 15 feet with a maximum of 60 feet. Between the fourth and fifth levels, a wide madocite dike cuts through the orebody, making mining of this stope area difficult. The talc ore sheet is closely folded and some variation in width of the ore zone is undoubtedly due to flowage of the soft talc between more competent bands of tremolitic dolomite. Along the margins and extremities of the ore zone, the foliated talc schist gives way to a fine-grained massive grey to apple-green steatite rock containing patches of foliated talc.

The north workings of the Conley Mine, centred about the No. 3 shaft, have yielded most of the production from the property for the past 10 years. This ore consists of a talcose tremolitic dolomite, in many places containing less than 30 percent talc. The dolomite in this area is highly contorted and commonly discoloured red, grey, or black. Stoping has been carried out both north and south of the shaft, and the ore appears to consist of irregular talc-tremolite replacement in crystalline white dolomite. Development had been carried out largely on the first level at 270 feet, but recent work has been concentrated on the third level at 542 feet.

Origin of the Talc: The best explanation as to the origin of these talc deposits is that of Wilson (1926) who regarded them as hydrothermal replacement deposits. Conformable sheet-like bodies of talc were developed from the Grenville dolomite by the introduction of hydrothermal solutions that probably originated from the neighbouring Moira Granite. These hot-water silica-bearing solutions ascended fractures and faults on the south limb of the anticline and altered the dolomite first to tremolite and then to talc. Evidence of this dolomite-tremolite-talc transition can be seen in thin sections of the rocks from the deposit. Subsequent folding and faulting is responsible for the crenulation, thickening, and offsetting of the talc ore sheets. The madocite dikes and the hydrothermal solutions probably had a common origin in the Moira Granite magma. The talc does not appear to be particularly associated genetically or spatially with the dikes themselves.

## Milling and Products

Mine run ore goes to a bin from which it feeds to a jaw crusher. The products from the jaw crusher go to one of three places depending on what

mine material is being processed. Talc ore from the Henderson Mine goes to a bin that feeds the Raymond grinding mill that is in closed circuit with a cyclone. The CANTAL products are produced from this ore.

Ore from the Conley stope goes to a second bin that feeds the Raymond grinding mill that is in closed circuit with the cyclone. TALFIL and DOLFIL products are produced from this ore, which is higher in dolomite.

Marble for terrazzo chips goes to a hammer mill. The product from the hammer mill goes to a bin and then to a double deck screen where two products are taken off. Fines go to the TALFIL or DOLFIL product line for regrinding in the Raymond mill.

The CANTAL products produced from the Henderson ore are CANTAL F/B, CANTAL 325, and CANTAL D. CANTAL F/B is the best grade of white talc used for pharmaceutical, cosmetic, and toilet preparations and for the polishing of glass lenses. It is 99.9 percent through 325 mesh and has a brightness of over 95. The chemical analysis is as follows: silica, 45.04 percent; magnesia, 30.16 percent; lime, 8.75 percent; iron oxide and alumina, 0.96 percent; loss on ignition, 15.17 percent. CANTAL 325 is similar to CANTAL F/B but has a brightness of 94. It may be used for pharmaceutical, cosmetic, and toilet preparations, polishing of glass lenses, bleaching of napkin and tissue paper, and for paint and ceramic products. CANTAL D is somewhat coarser than CANTAL F/B and 325. One hundred percent passes 200 mesh and 99.6 to 99.9 percent passes 325 mesh. It is used in the paint and ceramic industries.

TALFIL 325 is produced from ore from the Conley stope. It is suitable for general filler applications and is used: for polyester plastic; as a filler and carrier for insecticides; for formulating seed dressing; for marking playing fields; for compounding and dusting rubber products; for ceramic products; for automotive body filler; and for compounding and dusting of foundry facings. DOLFIL is a coarser version of TALFIL and is used: for

dusting the back of roofing products; for industrial hand soap; and for imitation marble products. CANFIL 325 has more talc and less dolomite than TALFIL and is used: for whitening of leather products; for brake linings; for pharmaceutical products; as a dusting agent; and for paper and rubber goods.

## DESCRIPTION OF INACTIVE PROPERTIES

### Frontenac County

#### Palmerston Township

Concession VI, Lot 6

A talc occurrence was visited by the author in lot 6, concession VI, Palmerston Township in 1949. A zone of talc-tremolite schist 50 feet wide was exposed intermittently over a length of 1,000 feet. The strike is east-west and the dip of the schist is vertical. The band is strongly dragfolded. To the south the country rock is hornblende gneiss. The talc schist is well exposed in a pit 20 feet long, 15 feet wide, and 6 feet deep. Test pits were reported to have been sunk in 1946 by Montgomery and Scott of Havelock.

#### Pittsburgh Township

Concession III, South Half of Lot 35

Spence (1940, p.77-78) reported that:

'... Dark, soft rock, that appears to be a partly altered pyroxenite, occurs on this lot and was worked about the year 1900 by the Sparham Roofing Company, of Montreal, who used the material in the manufacture of fireproof roofing. There are a few small scattered pits on the property, which lies 5 miles west of Gananoque, about one-quarter mile south of the Gananoque-Kingston road. A few hundred tons of material are reported to have been shipped. From its general appearance the rock probably consists largely of rensselaerite or pyrallolite, which is pyroxene in various stages of alteration to steatite, or massive talc.

'An analysis of the soft rock that occurs in several of the pits was made in the Bureau of Mines laboratory, and showed:

| | |
|---|---|
| Silica ..... | 50.64 |
| Ferrous oxide ..... | 0.79 |
| Ferric oxide ..... | 0.55 |
| Alumina ..... | 1.06 |
| Lime ..... | 4.84 |
| Magnesia ..... | 30.49 |
| Carbon dioxide ..... | 5.21 |
| Water above 105°C. ..... | 6.26 |
| | 99.84 |

'The rock is hardly to be classed as true talc, and it is probably mainly composed of mineral substance more closely allied to one of the serpentine group of minerals. The rock grinds to a grey powder possessing fair slip.

'According to the Ontario Bureau of Mines Annual Report, XI, 1901, p. 297, 1,800 tons of "serpentine rock" were quarried from a locality two miles west of Gananoque, in Leeds Township, during the six years 1896-1901. This material was taken out by Geo. Jackson, and was shipped to Montreal for roofing purposes.'

## South Canonto Township

### Mosque Lake Talc Property

Some pits and a shaft were sunk on a series of showings of grey-buff talc-tremolite dolomitic marble on lots 1 and 2, concession I, South Canonto Township. The showings are east of Mosque Lake, several hundred yards east of Mosque Lake Lodge. Samples from prospect pits on this property opened by

W.L. Peters of Maberley, Ontario were sent to the Federal Bureau of Mines (Spence 1940, p.77).

The favourable zone consists of foliated grey-buff tremolitic dolomitic marble striking N50E and dipping 70NW. The western pit is circular, 25 feet in diameter and 12 to 15 feet deep. Sheared tremolitic dolomitic marble contains some talc on shear planes. A few feet northeast of the western pit is a cut measuring 12 feet by 20 feet by 8 feet deep. Some talc is developed in sheared zones of the grey tremolitic dolomitic marble.

Pit No. 3 is a small cut with a 10-foot face about 100 feet northeast of the second pit. Two hundred feet northeast of pit No. 3, there is a timbered shaft twelve feet square, which is filled with water. Material on the dump is mainly grey tremolitic dolomitic marble with minor amounts of talc. There are quartz stringers in the marble, which has a slaty cleavage developed.

It has been reported that W.R. Bonter, T. Hutchison, and C. Spry of Madoc operated this property in 1941.

## Hastings County

### Cashel Township

#### Madoc Talc and Mining Company Limited

The Madoc Talc and Mining Company Limited held six claims in lots 16 and 17, concession XII and the south half of lot 16, concession XIII, Cashel Township. From January to October 1938 the company sank a shaft on a talc showing on lot 17, concession XII.

Spence (1940, p.76) described the deposit as follows:

'The main talc exposures lie on lot 17 of concession XII, where all of the development work has been done. The company had a small force engaged in shaft-sinking during 1938, and in November the shaft had been carried to a depth of 90 feet, timbered, 2-compartments, to 70 feet. A portable compressor and derrick-hoist comprised the mine equipment. Up to November 1, when the property was inspected, only small trial lots of talc had been shipped. The company reported having leased a building at Trenton, which it is proposed to equip with milling machinery, ore to be trucked to Gilmour, where it will be put on rail for shipment to Trenton.

'The shaft has been sunk directly on the talc outcrop, and underground development to date has consisted of a 50-foot crosscut at the 85-foot level with 125 feet of drifting on the ore-body. Inspection of the workings and material hoisted showed the deposit to consist of a vertical band, apparently at least 50 feet wide, made up of a greenish, rather fine-grained, chloritic talc schist. The band has suffered considerable shearing, with the development of thin layers or sheets of more highly talcose material. Within the schist lie some masses of a hard, dense, black rock, which may be of an intrusive nature, or which are possibly unaltered intercalated members of the original schist complex.

'In its general character, the talcose material rather resembles that of the "grit rock" of the talc deposits of the Waterbury district, in Vermont: it is of variable mineral composition, with zones containing considerable carbonate (dolomite) in fairly coarse grains, while semi-chloritized, fibrous hornblende is abundantly present as small knots in some bands. In part, the rock is of a soapstone, rather than a foliated talc, nature, and this type might perhaps serve for sawing into blocks. Selected

samples of the cleanest talc yielded a powder having good slip but of off-colour grade: run-of-mine material showed a considerable grit content and would probably only be suitable for the trades employing lower grade, grey talc, such as the rubber and roofing industries.

'An analysis of a sample of the crude talc from this deposit, made in the laboratory of the Bureau of Mines, showed:

| | |
|---|---|
| Silica ..... | 40.08 |
| Ferrous oxide ..... | 3.70 |
| Ferric oxide ..... | 1.87 |
| Alumina ..... | 1.75 |
| Lime ..... | 4.85 |
| Magnesia ..... | 29.91 |
| Carbon dioxide ..... | 13.45 |
| Water above 105°C. ..... | 4.12 |
| Total ..... | 99.63 |

'This would indicate a rather large content of dolomite, and the amount of iron present (in part as magnetite) is much above that of a good commercial talc.'

The Cashel Township talc occurrences are described in detail by S.B. Lumbers (1968, p.41-45). The talc-bearing zones are in mafic metavolcanics or at the contact between mafic and felsic metavolcanics. Lumbers (1968, p.41,43) stated that

'...Most commonly, the talc-rich rocks, which are medium-grained to coarse-grained and consist mainly of talc, dolomite, tremolite, and anthophyllite, and contain 2 to 15 percent disseminated iron-titanium oxide minerals, are bordered by chloritized and carbonatized amphibolite containing tremolite and minor anthophyllite.... In both the talc-rich rocks and in the

altered amphibolite, the anthophyllite is commonly intergrown with tremolite, and both amphiboles are partly replaced by talc. Locally, rocks composed mainly of tremolite and minor anthophyllite, both of which form crystals as much as three inches long, are found adjacent to some talc-rich zones. Crystals of talc as much as an inch in size are found near the borders of some talc-rich zones, and for the most part, talc within the zones occurs as fine-grained to medium-grained intergrown flakes, although fine-grained compact masses of talc are found locally. The amphibole content of the talc-rich rocks varies greatly both across and along the strike, and many of these rocks are rusty on weathered surfaces due to oxidation of iron-titanium oxide minerals.'

## Elzevir Township

### Concession III, Lot 9

On the old Fisher farm on lot 9, concession III, Elzevir Township, a trench 70 feet long, 8 feet wide, and 4 feet deep has been sunk in talcose grey volcanic rock with carbonate veinlets. The trenching is reported to have been carried out in the 1940s.

### Concession III, Lot 11

Wilson (1926, p.92) stated that:

'About 100 feet from the southeast corner of this lot a small opening 5 feet square and 2 feet deep, has been made in a zone of irregularly foliated talcose dolomite 15 to 20 feet wide and having an exposed length of 150 feet. The strike of the zone is north 70 degrees west magnetic and the dip 60 degrees southwest. Another outcrop of the same material occurs on the road side 100 feet to the northwest, so that the zone is at least several hundred feet long. This deposit is an alteration zone in greenstone

lava flows of the Grenville series and has probably originated ... through the metamorphic action of the intrusive batholith of granite that occurs about 1/2 mile to the northeastward.'

Concession IV, Lot 8

Several small pits have been put down on lot 8, concession IV, Elzevir Township, on veins of talc in serpentinized green volcanic rock. The main pit with a 10- by 8-foot face is blasted into the east side of a hill of sheared and serpentinized green volcanic rock. A 1- to 2-foot vein of coarse foliated talc is exposed trending N30W and dipping 50 northeast. Salmon pink calcite crystals occur with the talc.

Two hundred feet north of the main pit is a second pit 15 feet in diameter and 10 feet deep, excavated in the base of a mafic volcanic ridge. Dump material includes blocks of mauve-grey foliated talc. There are numerous other small pits with no rock showing. Some diamond drilling is reported to have been carried out in the 1930s.

Concession VI, Lot 5; Concession VII, Lots 4 and 5

The talc-actinolite deposits in Elzevir Township occur in talc-serpentine-actinolite carbonate rock in the mafic lavas of the Madoc Volcanics near their contact with the southern boundary of the large Elzevir Batholith. Wilson (1926, p.92) stated that the abundance of the talc-actinolite deposits in this area suggests that the transformation of the mafic lavas to talc and dolomite was brought about by the metamorphic action of the Elzevir intrusive batholith. He stated that:

'The deposits were originally opened by Joseph James, of Actinolite (formerly Bridgewater) in 1883, for use in the manufacture of roofing material, and were worked by him at intervals from that time to 1908, when they were purchased by the Actinolite Mining Company, Limited. A grinding

mill was built at Actinolite by the new owners, but this, except for a few weeks each year, has been idle since that time. The material from these deposits has been generally described as actinolite, but talc is by far the most abundant constituent.'

A sketch map is given by Wilson (1926, p.92) showing the location of the pits on these lots. The principal openings are on lot 4, concession VII, Elzevir Township. Pit No. 1, measuring about 100 feet long and 30 feet wide, is 10 to 20 feet deep and water-filled. It trends N70E. The rock is strongly sheared and altered mafic volcanics that are strongly serpentinized. Along the shear planes a talc-serpentine-carbonate rock is developed. A common rock type observed is a foliated, coarse-grained, purplish red talc-tremolite-carbonate-magnetite rock. Coarse aggregations of silver-white talc flakes are also developed.

Pit No. 2, located 300 feet west of pit No. 1, measures 15 by 10 feet by 10 feet deep. Some actinolite occurs in shears in grey-blue volcanic rock.

## Faraday Township

### Concession X, Lot 11

There is a small showing of talc on the southern shore of Pipe Lake, in lot 11, concession X, Faraday Township. The talc occurs with tremolite in impure bedded marble in outcrops 20 feet south of the lakeshore. The occurrence is poorly exposed.

On the northern side of the lake a little blasting has been done in a 5- to 15-foot wide band of white to buff quartzite containing rare 1/8-inch streaks of actinolite.

The occurrence is described by Thomson (1943, p.71).

## Grimsthorpe Township

### Concession IV, South Half of Lot 13

In 1948, five diamond drill holes were put down on a talc showing on the south half of lot 13, concession IV, Grimsthorpe Township by Active Exploration Prospecting Syndicate. The talc-bearing zone is in serpentinized greenstone. All holes cut talcose rock with a section of about 60 feet of talc and talcose rock in hole 5.

### Concession V, Lot 9

This talc occurrence is described by Wilson (1926, p.90):

'This deposit is situated about 1/2 mile northwest of an abandoned log road that follows Black river and Indian creek diagonally across the southeast corner of Grimsthorpe township. It lies 5 miles northeast of Lingham's flat and 11 miles northeast of Cooper post office. The deposit is a vertical northwesterly trending vein of translucent lamellar talc ... 10 to 14 inches wide, exposed in the bottom of an opening 1 to 4 feet wide and 3 feet deep that has been excavated in the front of a southeastward-facing rock scarp 12 feet high. Except for an aggregate of coarsely crystalline dolomite in the middle of the vein at one point, the deposit consists entirely of talc, the foliae of which, in places, extend the whole width of the vein. The rock cut by the vein is a fine-grained, hard, greenish grey type which under the microscope is seen to consist almost entirely of serpentine and scattered aggregates of carbonate.

'Three hundred feet northeast of this occurrence a second pit 2 to 4 feet wide and 1 to 3 feet deep has been opened up in the same rock face in a zone of fibrous actinolite 2 to 4 inches wide that cuts transversely across a zone of coarse, pale green amphibolite. The amphibolite zone has an

exposed width of 5 feet, trends north 70 degrees east, and dips 70 degrees southeast.

'This deposit, although, as exposed, of too small extent to be workable, is of interest because it consists of the foliated variety of talc that generally occurs in veins cutting soapstone or less pure deposits of talc; because it contains nickel, and because of its exceptional purity as shown by the following analysis.

| | |
|---|---|
| $SiO_2$ ..... | 60.45 |
| $Al_2O_3$ ..... | 0.27 |
| $Fe_2O_3$ ..... | 0.78 |
| FeO ..... | 2.04 |
| NiO ..... | 0.50 |
| CaO ..... | 0.16 |
| MgO ..... | 29.84 |
| $H_2O$ at 100°C ..... | 0.32 |
| $H_2O$ above 100°C ..... | 5.42 |
| | 99.78 |

'It is probable that this talc is related in origin either to the serpentine in which it occurs or to a related highly magnesian rock underlying the depression to the southeast of the deposit. In most localities where talc of this type is associated with serpentine, the serpentine has been transformed to soapstone where the vein occurs, but in this case the soapstone is absent, so that the talc has apparently been formed directly from the serpentine. It is possible, however, that soapstone underlies the depression to the southeast of the deposit and the vein has been derived from this source. If this be the case, the vein probably widens towards the southeast.'

## Huntingdon Township

### Price Mine, Concession XIV, Lot 15

In 1941 and 1942, the Trent Mining Syndicate Limited sunk two shafts on the northeast quarter of lot 15, concession XIV, Huntingdon Township. The property is known as the Price Mine. The principal shaft is 90 feet deep with levels at 40 and 80 feet. The dolomite strikes N10E and dips 55W. The shaft was dewatered when the property was visited by the author in August, 1949. On the 40-foot level, a drift goes 140 feet north along a narrow sericite-talc schist zone. The talc zone exposed in the drift is 2 to 5 feet wide and cuts siliceous dolomitic marble. The drift runs N10E parallel to the strike of the dolomitic marble band. A crosscut running east for 15 feet from the station cuts into a green serpentinized schist footwall. A crosscut running west for 85 feet from the station exposes a hangingwall of black graphitic schist and amphibolite. On the 80-foot level, 108 feet of drifting is reported.

A pit 15 feet long, 12 feet wide, and 4 feet deep, was put down in fine-grained buff to white marble 150 feet northwest of the shaft. Pits east of the shaft expose foliated sericite carbonate schist, which is green in colour due to chlorite and serpentine.

Some work on the lot by the Asbestos Pulp Company is reported by Wilson (1926, p.89).

### International Pulp Company, Concession XIV, Lot 16

Three shafts were put down in lot 16, concession XIV, Huntingdon Township, between 1917 and 1919 by the International Pulp Company of Gouverneur, New York (Wilson 1926, p.89-90).

Shaft No. 1, a few hundred feet south of the farm buildings, is 50 feet

deep with 130 feet of drifting and crosscutting. Rock on the dump consists of mica schist, dolomitic marble, some talc schist and massive talc.

Shaft No. 2, near the western boundary of the lot, is reported to be 60 feet deep with 110 feet of drifting. The dump consists of talc-tremolite schist and dolomitic marble.

Shaft No. 3, 70 feet northeast of shaft No. 1, is 25 feet deep, and the excavated material is grey to white talc schist.

## Lake Township

### Concession X, Lots 15, 16, 17, 18

A talc occurrence in Lake Township is described as follows by Laakso (1968, p.28):

'A low-grade talc-bearing band, in lots 15, 16, 17, 18, concession X, parallels the west bank of Beaver Creek.

'The talc occurs in a talc-tremolite-carbonate band enclosed in dolomite and along what appears to be a fault zone. The strike of the narrow talc-bearing band is N10°E and its dip is vertical. Lenses of bluish quartzite are also found in the dolomite. The Tudor gabbro is about 300 yards east of the talc band; a fine-grained bluish calcareous marble is present toward the west.'

## Madoc Township

### Concession XI, Lot 15

Wilson (1926, p.77) described a talc occurrence on lot 15, concession XI, Madoc Township, as follows:

'A zone of impure talc-dolomite schist 5 feet wide is exposed in a

prospect pit 10 feet square and 5 feet deep on the slope of a rocky ridge situated a few hundred feet east of the farm house on this lot. The foliation in the schist is uniform along the east wall of the opening, but elsewhere it is irregular. This deposit, like those in Elzevir township to the eastward, is an alteration zone in the greenstone lava flows of the Grenville series that form an extended area along the boundary between Madoc and Elzevir townships.'

Eldorado Talc Mine, Concessions IV and V, Lots 20 and 21

The Eldorado talc mine is on the eastern bank of the Moira River with the main workings and buildings in lot 20, concession V, Madoc Township. The talc schist extends into lot 21, concession V, and lots 20 and 21, concession IV. The mine was worked from 1911 to 1920, but has been idle since.

Wilson (1926, p.68) reported that William Hungerford purchased the mining rights to lot 20, concession V, from G.D. Gordon in 1911 and organized the Eldorado Talc and Silica Company which sank a 75-foot inclined shaft and built a mill. The company was reorganized in 1914 as Eldorite Limited and operated until 1916. In 1919 the Eldorado Mining and Milling Company took over the property and operated it until November 1920. Since then it has remained idle and the buildings have been torn down.

The No. 1 shaft was sunk in 1911 to a depth of 75 feet on an incline of 75 degrees to the west. From 1914 to 1916 the No. 1 shaft was deepened to 90 feet and a second shaft was sunk to a depth of 130 feet on an incline of 75 degrees to the northwest. The No. 2 shaft is located about 100 feet north of No. 1 shaft. Two hundred feet of drifting was carried out on the 65-foot level to connect the two shafts. From 1918 to 1920 the shafts were deepened to 200 feet with levels at 65 and 200 feet. Drifting on the

200-foot level was reported to be 30 feet southwest of No. 1 shaft and 160 feet northeast of No. 2 shaft. The shafts were connected on this level. Eleven short crosscuts were run off this drift. Five small surface prospect pits were put down on surface.

The talc occurs in a pale grey-green to snowy white talc-tremolite-dolomite schist that also carried considerable numbers of quartz lenticles. The schist has thin sandy marble interbeds. The width of the talc-bearing schist is approximately 100 feet. Talc content is reported by Wilson (1926, p.73) to average about 20 percent. The talc schist zone extends northwest from shaft No. 1 with a dip of 40 to 60 northeast. At the shaft the zone appears to fold around to the southwest in an anticlinal structure. The rocks are highly folded and crenulated. There is a strong mineral lineation exposed in the shafts pitching northeast at about 40. Dikes of granite cut the marble in lot 21, concession IV.

Spence (1940, p.73) reported that:

'...A short distance to the east of the main deposit, a 20-foot band of crumpled, dark grey, graphitic talc schist outcrops, and in 1919 a separate small mill unit was installed to grind this material for the rubber and foundry trades.'

## Wollaston Township

### Concession XI, Lots 8 and 9

A small pit measuring 8 by 10 feet by 10 feet deep, was sunk on a talc showing in lot 8, concession XI, Wollaston Township. The pit is located about 1/2 mile north of the Deer River. The talc occurs in a white tremolite-diopside rock that forms a narrow band striking N20E, dipping 60 to 70W. The talc-bearing material consists largely of tremolite and is

quite hard. It occurs in a linear valley between two ridges of white crystalline dolomitic marble. Syenite intrudes the marble.

Other trenches were put down on the zone to the south along strike, but no good quality talc was observed by the author. The talc-bearing zone is reported to have been drilled in the 1930s by Roy Taylor of Canada Talc Company, Madoc.

## Kenora District

### Lake of the Woods

Occurrences of talc and soapstone in the Lake of the Woods area are referred to by Wilson (1926, p.56) as follows, quoted partly from Lawson:

'Pure talc, of pearly, whitish-green, foliated aspect, occurs in small segregations in some of the softer green schists of the islands of the lake, and some handsome specimens have been brought into Rat Portage (Kenora), said to be from an island 2 miles south of the town. Although this pure talc is sometimes ground and used as a lubricant or polisher, it is doubtful if it occurs in sufficient quantities on the Lake of the Woods to be of economic value. The less pure, grey-coloured granular variety of talc, known as soapstone or steatite, is, however, more abundant, and forms at least one extensive deposit which constitutes the rock on both sides of the canoe channel, 1-3/4 miles southwest of French portage, for a distance of a hundred yards or more. This place has long been resorted to by the Indians for material for their pipes. The rock is soft, sectile, and frequently free from grit, taking a moderately fine polish with ease; it presents excellent facilities for quarrying, and would require no intermediate transport from the quarry to the barges. It lies within a few

hundred yards of the regular tug channel through the lake, and will doubtless be of considerable value as the nearest source of supply of furnace linings, fire-stones, slabs, etc., when those commodities come into demand in Manitoba and the west.

'Impure serpentines or soapstones occur in a few localities, most characteristically, however, on the narrows to the south of French portage. The soapstone or pipestone of Pipestone point is simply a soft, decomposed, or stealitic variety of green hornblendic schists, and is not used by the Indians for making their pipes.

'In 1915 shipments of schist similar to that on Pipestone point were made from an unpatented claim situated on the Pipestone portage about 3-1/2 miles east of Pipestone point to the Dryden Timber and Power Company for lining smelting furnaces, but proved unsatisfactory for the purpose.'

Spence (1922, p.34) reported that this shipment of stone proved too seamy for furnace linings and did not stand up under the heat. The stones possess the character of a soft chloritic slate. The occurrence is described again in his later report (Spence 1940, p.63-64).

## Wabigoon Area

Occurrences of soapstone in the Wabigoon area are described as follows by Satterly (1941, p.53-55):

'Wabigoon Soapstone Company Limited

'Claim H. W. 133 of Wabigoon Soapstone Company, Limited, is situated about 1-1/2 miles west of Wabigoon station in Zealand township, and the soapstone deposits are on a rocky hill in the peninsula that forms the west boundary of Barritt bay on Wabigoon lake. They can be reached from the lake or by a disused road from the C.P.R. tracks. The rocky hill, formerly

cleared, is in part covered by small second-growth poplars. Wright states that this occurrence was bought by E. G. Pidgeon in 1921 and that he had a considerable amount of stripping done to determine the area of the deposit and quarried several cubic feet for test purposes. In 1922, E. G. Pidgeon sold a half interest to H. H. Sutherland, of Toronto, and the Wabigoon Soapstone Company, Limited, was organized. This company did some development work in 1926 and 1927. At the time of the writer's visit in September, 1939, the test pits and trenches on the deposit were partly grown over, and it is understood that no development work has been done in the last ten years.

'The soapstone deposits occur in a gabbro mass, which underlies most of the peninsula, and the island to the northwest on which the Indian cemetery is located. This mass presumably extends under much of Barritt bay, as it is found on islands and in the village of Wabigoon. The gabbro is, in places, fairly fresh, but adjacent to the soapstone deposits it is highly altered. Two specimens of it studied in thin section under the microscope are found to consist of plagioclase with clouds of clinozoisite, felted aggregates of an amphibole probably derived from a pyroxene, and in one section a minor amount of quartz. The rock is believed to have been originally a gabbro, as related masses are of this composition. The soapstone is a dark-grey, soft rock containing in some samples rhombs of a brown carbonate. The soapstone has been trenched in two places, and Wright states that there are two bands. A thin section of grey soapstone with brown carbonate rhombs shows, under the microscope, an aggregate of antigorite with bands of magnetite, talc, chlorite, and an iron carbonate. This mineral assemblage indicates that the original rock was ultrabasic in composition.'

Table 2 Analyses of two samples of soapstone (after Spence 1922, p.36)

| | No. 1 | No. 2 |
|---|---|---|
| | percent | percent |
| $SiO_2$ ..... | 41.94 | 51.44 |
| $Al_2O_3$ ..... | 7.57 | 4.79 |
| $Fe_2O_3$ ..... | 2.05 | 3.68 |
| FeO ..... | 7.71 | 7.24 |
| MgO ..... | 25.39 | 26.43 |
| CaO ..... | 3.42 | none |
| $CO_2$ ..... | 5.09 | .11 |
| $H_2O+$ ..... | 6.71 | 6.56 |
| Total ..... | 99.88 | 100.25 |

Sample No. 1 - Wabigoon soapstone, representative material of Wright's north band.

Sample No. 2 - Wabigoon soapstone, 18-inch band on contact of above.

'The results of laboratory tests and analyses and the economic possibilities of the Wabigoon soapstone are given in the reports by Spence and the reader is referred to them for further details.'

'Mile Lake

'Two occurrences of soapstone have been noted on Mile lake. One of these is on the southeast shore of the lake, where the rock is an altered gabbro capped by clay, in which there are a number of caved-in trenches. One chain in from the shore is an outcrop of soapstone, which has been blasted, and blocks have been sawn, presumably for test purposes. The soapstone is medium-grained and blotchy green and grey, and is probably a highly altered, ultrabasic lens in the gabbro.

'The other occurrence is on the northwest shore of the lake near the west contact of the gabbro mass and is a greenish, coarse-grained rock with aggregates of biotite, probably metamorphic in origin. This rock does not appear to be of the same type as that on the southeast shore.'

'Trap Lake

'The soapstone deposits on Trap lake outcrop on islands Nos. 246 and 249 near the outlet of the lake. The main occurrence is on the larger island, No. 246, and a number of caved-in trenches in the clay capping are reported to indicate that the whole island consists of soapstone. The northwest point of the island is a favourite picnic camp site, and a sample from this point, where the soapstone is fairly massive but has widely spaced fractures, is medium-grained and grey and green in colour, the two colours representing pseudomorphs after two minerals. In thin section under the microscope the aggregate consists of talc, carbonate, and antigorite, with a minor amount of penninite and iron ores. The original two minerals were probably olivine and a pyroxene. The olivine is represented by an aggregate of talc; carbonate, with grains of iron ore; and some antigorite. The pyroxene pseudomorph shows strips of antigorite at right angles to each other, presumably paralleling two sets of cleavages, with a

talc aggregate between these strips. The original rock was, therefore, a variety of peridotite; as harzburgite occurs on a nearby island, the rock was most likely that species.

'On island No. 249 the soapstone is fairly massive, medium-grained, and greyish-green in colour. The reef just southwest of this island is also a medium-grained soapstone composed of a green mineral in a chocolate-brown groundmass. These occurrences are also believed to be altered harzburgites.

'The origin of the soapstone deposits near Wabigoon and on Mile and Trap lakes is uncertain. Field and microscopic evidence would indicate that all the soapstones could be derived from the alteration of harzburgite, which apparently occurs as ultrabasic segregations in the gabbro masses. As fairly fresh harzburgite occurs on island No. 247 in Trap lake, it is apparent that the alteration of the harzburgite masses tended to be local. On Mile and Trap lakes the gabbro mass is cut by numerous felsite and quartz porphyry dikes, and it is thought that the hydrothermal activity accompanying the injection of these dikes has caused the development of the soapstone. The soapstone deposit near Wabigoon is reported not to extend to depth, but it may be noted that a granite stock lies only 1 mile to the southeast of the deposit and may be the cause of the development of the soapstone from a lens of an ultrabasic rock in the gabbro mass.'

Wilson (1926, p.63-66) and Spence (1940, p.64) also described an occurrence of soapstone on an island in Trap Lake. In 1923 Thermo-Stone Quarries Limited of Toronto was formed to develop the property. This company was amalgamated in 1924 with the Wabigoon Soapstone Company and a small amount of surface work was carried out. Little or no production was reported. As mentioned by Satterly (1941) the main deposit occurs on islands 246 and 249 in Trap Lake, 9 miles south of Dryden.

Satterly's (1941) Dryden-Wabigoon report continues with a description of Zealand Township.

'Zealand Township

'Some soapstone occurrences associated with the Thunder River volcanics in concession III, Zealand township, have been noted by Pettijohn. The largest of these is believed to be a small boss, as it appears to truncate the strike of the sediments at the north contact of the Thunder River volcanics in the north half of lot 6, concession III. In the north half of lot 4, concession III, three exposures of soapstone are thought to represent a thin sill, intrusive into the volcanics. One other sill was found in an outcrop near the west boundary of the south half of lot 4, concession III.

'Soapstone occurs in sill-like bodies in lot 17, concessions VII and VIII, Zealand township, and in Brownridge township about 1 mile north of lots 7 and 8, concession VI, Zealand township. These two sills may be remnants of a single sill, as they occur at about the same horizon in the Brownridge volcanics. In the burnt outcrops, where these pale reddish-brown sills occur, they stand out in contrast to the surrounding dark-green to black colour of the volcanics. A thin section of a specimen from lot 17, concession VIII, Zealand township, shows an aggregate of fractured and altered olivine, amphibole, chlorite, and accessory iron ores and rare feldspar grains. The rock is an altered peridotite. These sills range from 30 to 100 feet in thickness. Tourmalinization of the adjacent volcanics or the margin of the sill has resulted in the formation in several localities of a tourmaline amphibolite. Associated with this rock in places are quartz-tourmaline veins. It would, therefore, seem highly probable that the development of the soapstone in these sills is due to hydrothermal action accompanying the injection of these quartz veins.'

## Eagle Lake

An occurrence of soapstone on Eagle Lake is described by Spence (1940, p.66) as follows:

'...A band of soapstone, reported to be about 100 feet wide, occurs enclosed in talc-chlorite schist on the southwest shore of Eagle Lake. The location is 21 miles distant by water from either Eagle River or Vermilion Bay station on the main line of the Canadian Pacific Railway, to which water shipment can be made.

'In 1924, the Grace Mining Company commenced development of the deposit, erected a camp, and installed a large sawing plant. Work was continued for a few years, and several carloads of cut furnace stone were shipped to nearby pulp mills at Dryden and Fort Frances, Ont. The stone is stated to have proved satisfactory for such use, but, possibly for lack of a sufficient market, work was discontinued about 1927-28 and has not been resumed.

'A small quarry ... was opened close to the edge of the lake, and the stone was cut out in 3-foot benches by means of a Sullivan channeller, working at right angles to the strike of the deposit. Quarry blocks were lifted by derrick and dropped onto small flat-cars, which ran directly to the sawing shed. This was a large, substantial building equipped with three 15-foot gang saws. Sand, obtained locally, was used to feed the saws.

'The output consisted entirely of furnace blocks and bricks, the former chiefly of 12 by 12 by 12 inches and 12 by 12 by 18 inches dimensions.

'The stone is light green in colour, of medium grain, and inclined to schistose in structure. An analysis of a representative sample, made in the Bureau of Mines laboratory, showed:

| | |
|---|---|
| Silica | 43.20 |
| Ferrous oxide | 7.95 |
| Ferric oxide | 3.51 |
| Alumina | 6.74 |
| Lime | 1.30 |
| Magnesia | 27.64 |
| Carbon dioxide | 1.95 |
| Water above 105°C | 7.80 |
| | 100.09' |

Shoal Lake

An occurrence of soapstone on the north shore of Shoal Lake, 26 miles southwest of Kenora is described by Wilson (1926, p.53) and Spence (1940, p.64).

## Lanark County

### Lavant Township

Concession III, East Half of Lot 24

A talc deposit on the lot is described as follows by Spence (1940, p.78):

'Diamond drilling on a talc body on this lot was done around 1918 by the owner, T.B. Caldwell, of Perth, Ont. One 120-foot drill hole was put down, and a few shallow prospect pits were opened.

'The property lies 2 miles south of Flower Station, on the Kingston and Pembroke branch of the Canadian Pacific Railway, but is actually distant only one-fourth of a mile from another point on the railway, with which, however, there is no road connection.

'The deposit consists of a low, denuded hogsback, about 50 feet wide, and extending 300 feet in a northeast direction. Several small prospect pits have been opened at the base on the west side. The apparent dip is 20 degrees east.

'The material of the ridge, as exposed on the surface and in the pits, is a fine-grained, white, silceous, serpentinized dolomite, representing a band of altered, high-magnesia limestone in the Precambrian gneiss-limestone complex. The silica is prominent on weathered surfaces as small nodules or stringers of quartz, that form possibly 5 percent of the mass. The rock effervesces freely with acid, showing that considerable calcite is present. The magnesium silicate present would appear to be more of the nature of serpentine than talc, as very little talc can be detected under the microscope, and there is not sufficient present to impart more than a slight slip to the powder, which is distinctly gritty.

'The following are analyses of the material of this deposit. No. 1 was made in the Bureau of Mines laboratory on a representative sample collected from the various pits and outcrops; No. 2 was made at the School of Mines, Kingston, Ont., and was furnished by the owner:

| | 1 | 2 |
|---|---|---|
| Silica | 52.50 | 57.70 |
| Ferrous oxide | 0.28 | - |
| Ferric oxide | 0.10 | 1.10 |
| Alumina | 0.17 | - |
| Lime | 9.26 | 4.96 |
| Magnesia | 26.04 | 26.78 |

| | | |
|---|---|---|
| Carbon dioxide ..... | 6.85 | 1.90 |
| Water above 105°C ..... | 5.13 | 7.21 |
| Total ..... | 100.33 | 99.65' |

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Packenham Township

Concession VI, West Half of Lot 6

A talc occurrence on this lot is described by Spence (1940, p.79) as follows:

'In 1937, some prospecting was done on this lot by J. Bell, of Almonte, who opened several small surface pits on exposures of steatitized pyroxenite in a white, crystalline dolomite formation. The occurrence lies about 6 miles southwest of Pakenham station, on the Canadian Pacific Railway.

'The talc on this lot consists entirely of a soft, yellowish to pale brown rensselaerite-steatite, derived from narrow, dyke-like bodies of pyroxenite enclosed in white, crystalline dolomite. The original pyroxene was in the form of irregular bands of very coarsely crystalline rock, with individual crystals up to 3 by 2 inches, which border on narrow bodies of quartz or quartzite. The original form of the pyroxene crystals has been preserved. The dolomite in contact with the pyroxenite and quartz bodies has been partly serpentinized. None of the exposures indicate any large body of clean steatite, and most of the rock broken consists of a mixture of this material with dolomite, serpentine, and quartz. It grinds to a fairly white powder, which, however, lacks slip on account of the impurities present, but might yield an inferior grade of talc for roofing or rubber purposes. In the more quartz-free zones, the rock cuts fairly easily and

can be sawn into small blocks, but these are badly flawed and spall readily.

'The original intention was to develop the deposit as a source of stone for the production of cut and turned small ornamental articles, but owing to its coarse, irregular grain and checked character it probably would prove unsuitable for such purposes.

'A small shipment of the material was made to the laboratories of the Bureau of Mines in 1937 for a grinding test. Analyses of the Gayco fines (1) and oversize (2) from this test were made in the laboratory of the Bureau; analysis (3) is of a sample analysed by the National Research Council, Ottawa:

| | 1 | 2 | 3 |
|---|---|---|---|
| Silica ..... | 59.10 | 60.92 | 57.27 |
| Ferrous oxide ..... | 0.35 | 0.39 | 0.51 |
| Ferric oxide ..... | 0.17 | 0.23 | 0.72 |
| Alumina ..... | 0.52 | 0.38 | 0.74 |
| Lime ..... | 2.10 | 0.68 | 3.20 |
| Magnesia ..... | 30.50 | 30.62 | 29.34 |
| Carbon dioxide ..... | 1.26 | 0.72 | 7.94 |
| Water above 105°C ..... | 5.78 | 5.78 | 0.28 |
| Total ..... | 99.78 | 99.72 | 100.00 |

'The figures for sample 3 show considerable carbonate to be present, while the low water content indicates only a small degree of talcification of the pyroxene. Samples 1 and 2 are a much better grade of material.'

## Lennox and Addington County

### Kaladar Township

Concession V, Lot 2

Prospect pits for talc are reported to have been put down on lot 2, concession V, Kaladar Township. The minor occurrence of talc is described by Wilson (1926, p.94). A zone of talc schist two feet wide is exposed in a pit 12 feet long, 10 feet wide, and 10 feet deep.

## Rainy River District

### Pipestone Lake

Wilson (1926, p.66) reported occurrences of soapstone near the northern end of Pipestone Lake and at Rock Island Bay in Watten Township.

### Seine River

Spence (1940, p.67) reported an occurrence of soapstone from the northern side of the Seine River about 25 miles west of Atikokan station.

## Sudbury District

### May Township

Spence (1940, p.67) described a talc occurrence in May Township as follows:

'In an early report of the Ontario Bureau of Mines, reference is made to an occurrence of talc "in the southeast corner of May township, Algoma district, 10 miles from the railway by wagon road". The Spanish River

Nickel Mining Company is reported to have sunk a 40-foot shaft on this deposit in 1896, the vein widening from 2-1/2 feet at surface to 11 feet at 40 feet.

'In 1910, further work was done on these workings by the Gaugir Talc Company, who deepened the shaft to 50 feet, at which depth the deposit pinched out due to faulting. This company erected a small mill at Lee Valley, 10 miles south of Massey station, and produced a small amount of ground talc for foundry use. The ore is stated to have consisted of an intimate mixture of talc and graphite, which proved an excellent foundry material. Wilson stated that the supposed talc is really sericite. No further work has been done on the property.'

## Panache Lake

An occurrence of soapstone was reported on the northeast shore of Panache Lake by Wilson (1926, p.67).

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